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Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Part 97 of the Commission's Rules Governing the Amateur Radio Service to Facilitate Spread Spectrum Communication	)	RM-8737

To: The Commission

REPLY COMMENTS OF WILLIAM A. TYNAN W3XO

Indtroduction

I have been a licensed amateur since 1945, obtaining the callsign W3KMV in early 1946. I upgraded to Class A (later called Advanced) in the fall of 1946 and to Extra in the early 70s. I obtained my present callsign in 1976. Throughout those 50 years, my principal interest has been in the bands above 50 MHz. I am currently operational on all bands from 50 to 1296 MHz. For eighteen years, from 1975 until 1992, I served as Contributing Editor to QST Magazine, responsible for the monthly column "The World Above 50 MHz". I was one of the founders of the Radio Amateur Satellite Corporation (AMSAT) and have been serving as its President since 1991.

News of the filing of this Proposal was very limited and I did not become aware of it until the day before I was to leave on a trip to Europe for AMSAT. As a result, I was not able to prepare comments before the filing date of February 29th. Therefore, I am filing Reply Comments and ask that the Commission accept them as part of the official record in this proceeding.

Summary

I have major reservations concerning the Petition for Rule Making filed by the American Radio Relay League last December. Although I am in favor of developing new technology in the Amateur and Amateur Satellite bands, including Spread Spectrum (SS) techniques, I am concerned that SS's widespread use, with no frequency restrictions, will cause major interference to satellite operation as well as to weak signal terrestrial and EME work. Therefore, I strongly suggest that any relaxation of the spread spectrum rules that the Commission may decide upon, should be accompanied by restrictions limiting it to specific frequency segments within the Amateur and Amateur Satellite bands. Otherwise, it has the potential to make reception of the relatively weak signals from amateur satellites, distant terrestrial stations and signals reflected from the Moon, all but impossible in many parts of the country, particularly in urban areas.

In support of this contention, I cite both calculations made relative to potential SS signal levels and the ARRL's own statements with regard to potential interference which Spread Spectrum might cause.

Discussion

To obtain a measure of the possible interference that could result from only a single spread spectrum station, the following parameters are assumed:

Spread spectrum station with an effective power of 100 W ERP =

+20 dBW

If spread over 10 MHz -50 dBW/Hz

Free-space attenuation at 20 km from the spread spectrum station in the 70 cm (420 - 450 MHz) band = -110 dB

Spread spectrum signal at 20 km = -160 dBW/Hz

A receiver with a 1 dB NF (common in satellite & weak signal work) = -210 dBW/Hz

This results in the spread spectrum signal causing as much as a 50 dB increase in the noise floor existing without it.

Even if the SS station has a power of only 1 W ERP (20 dB less), the noise floor would still be as much as 30 dB higher because of its presence. Similar calculations for other distances can also be done. For example, the spread spectrum signal would be 20 dB stronger at a 2 km distance. As another example, a 100 W transmitter and 10 dB gain antenna could create 10 dB more interference. Obviously, if the spread spectrum station is in close proximity to the satellite, terrestrial weak signal or EME, station, the degradation from the spread spectrum station's operation would be much greater.

The effect of automatic power control for SS stations using transmitters over 1 W is difficult to asses, but one can envision situations in which interference from other SS stations, as well as non-SS stations, might cause the SS station(s) to increase their power in order to retain the desired signal to noise ratio. In such a case, power control would do nothing to

alleviate interference for other users of the band.

It might be said that antenna directivity would provide protection. I believe that, with increases in noise floor as great as these cited above, antenna directivity will not help much. If the increases were in the order of 5 to 10 dB antenna directivity might be of some benefit, but not for the cases noted. The reason for this is that few amateur satellite ground stations, or even terrestrial weak signal operators, have antennas with side lobes down 30 dB. I am not sure that even EME operators have antennas that good. In addition, there are many instances in which antennas being used to receive amateur satellites, or signals reflected from the Moon are pointed, near the horizon rather than being elevated. For example, LEO satellites are typically below 10 degrees elevation approximately half the time during which they are within range of a given location. Of course, antennas for terrestrial work are always pointed at the horizon. In these cases, there is no improvement from using directive antennas if an interfering spread spectrum station happens to be in the same direction as the desired satellite, terrestrial station; or even the Moon.

The received signal strength for EME stations on 70 cm is in the order of -150 dBm, many times even less. Obviously, because of such extremely low received signal strengths, ANY increase in noise floor would be sufficient to render successful EME work impossible. Therefore, significant use of SS, which might include 432 MHz would probably spell the death knell for EME as a viable mode on that band.

In their petition, ARRL goes to some length to state that "unintentional triggering of repeater inputs" is not considered

interference, and that therefore the section of the rules dealing with it should be removed.

It seems to me that this proves that even they believe that spread spectrum operation may well result in significant noise floor increases. Certainly if they are sufficient to trigger FM repeaters, they are sufficient to drastically degrade reception of weak satellite, terrestrial or EME signals.

Proposal

I believe that spread spectrum operation should be encouraged. I think that it will eventually prove to be a valuable mode for both terrestrial and satellite applications, and maybe even EME. However, I believe that it should be restricted to certain frequency segments so as to offer minimal interference to other modes, while still allowing experimentation. The Commission has done this in other amateur rules. For example, voice operation is limited to certain segments in the HF and VHF amateur bands. Unattended digital operation is restricted to certain small segments in the HF bands and unattended beacons are limited to specific segments on 10 meters through 70 cm.

To alleviate the kinds of interference cited, I believe that spread spectrum should not be allowed below 450 MHz. I know that the current rules allow it in the 420 - 450 MHz band, It may be argued that this proves that spread spectrum poses no threat to other types of operation, since no reports of interference have been registered in the ten years since it was authorized. However, the ARRL admits in their Petition that SS operation has not been widespread. This is probably an understatement. I am not aware of the results of any SS operation. None were reported

to me when I was writing The World Above 50 MHz and no papers on amateur SS experiments have been given at AMSAT's annual Space Symposiums. Specifically, I know of no reports of tests showing the potential interference to other modes of operation including weak signal modes, by SS operation even though SS operation has supposedly been taking place since 1985.

I would like to see spread spectrum develop and become a major factor in Amateur Radio, especially on the microwave bands. But, I do not think it should be allowed to do so to the detriment of other modes of operation. It has not been demonstrated that it won't.

In order to allow it to fulfill its potential and still protect these other types of operation, I believe that spread spectrum should be authorized only in certain band segments beginning in the 33 cm (902 - 928 MHz) band. Specifically it should be placed in segments that provide protection for weak signal terrestrial and EME operation which occur in fairly narrow segments at 432, 902, 1296, 2304, 3456, 5760 and 10,368 MHz.

Such an approach will also protect amateur satellite operation in the 435 - 438 MHz band. It might be possible to allow SS in the 1260 - 1270 MHz (uplink only) and 2400 - 2450 MHz satellite bands, but that should be studied prior to doing so. Certainly, SS should be allowed in some satellite bands, as it will probably prove useful for satellite work in the future. Possibly restricting it in the lower 5 or 10 MHz portion of the 2400 - 2450 MHz band, but permitting it in the upper portion, would protect existing, and near-term future, amateur satellite operation and still permit the use of Spread Spectrum with satellites designed for it in the years to come.

Conclusion

I urge the Commission to not permit SS to continue in the 70 cm band and certainly not permit it in lower VHF bands as some may argue. If other kinds of operation, such as ATV and packet are any guide, those people interested in developing SS techniques are most likely to settle in the lowest frequency band permitted. This is only natural, as their principal interest lies in the techniques involved, rather than in the radio wave propagation and/or RF equipment aspects.

RESPECTFULLY SUBMITTED,

William A. Tynan W3XO

March 11, 1996